

## 4. Recommendations

### 4.1 New Recommendations

As a result of the investigation of the TWA flight 800 accident, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration (FAA):

Examine manufacturers' design practices with regard to bonding of components inside fuel tanks and require changes in those practices, as necessary, to eliminate potential ignition hazards. (A-00-105)

Review the design specifications for aircraft wiring systems of all U.S.-certified aircraft and (1) identify which systems are critical to safety and (2) require revisions, as necessary, to ensure that adequate separation is provided for the wiring related to those critical systems. (A-00-106)

Require the development and implementation of corrective actions to eliminate the ignition risk posed by silver-sulfide deposits on fuel quantity indication system components inside fuel tanks. (A-00-107)

Regardless of the scope of the Aging Transport Systems Rulemaking Advisory Committee's eventual recommendations, address (through rulemaking or other means) all of the issues identified in the Aging Transport Non-Structural Systems Plan, including

- the need for improved training of maintenance personnel to ensure adequate recognition and repair of potentially unsafe wiring conditions;
- the need for improved documentation and reporting of potentially unsafe electrical wiring conditions; and
- the need to incorporate the use of new technology, such as arc-fault circuit breakers and automated wire test equipment.

To determine whether adequate progress is being made in these areas, the Safety Board believes that, within 90 days, the Federal Aviation Administration should brief the Safety Board on the status of its efforts to address all of the issues identified in the Aging Transport Non-Structural Systems Plan. (A-00-108)

## 4.2 Previously Issued Recommendations Resulting From This Accident Investigation

As a result of the TWA flight 800 accident investigation, the Safety Board issued the following safety recommendations to the FAA on December 13, 1996:

Require the development and implementation of design or operational changes that will preclude the operation of transport-category airplanes with explosive fuel/air mixtures in the fuel tanks:

(a) Significant consideration should be given to the development of airplane design modifications, such as nitrogen-inerting systems and the addition of insulation between heat-generating equipment and fuel tanks. Appropriate modifications should apply to newly certificated airplanes and, where feasible, to existing airplanes. (A-96-174)

(b) Pending implementation of design modifications, require modifications in operational procedures to reduce the potential for explosive fuel/air mixtures in the fuel tanks of transport-category aircraft. In the 747, consideration should be given to refueling the center wing fuel tank (CWT) before flight whenever possible from cooler ground fuel tanks, proper monitoring and management of the CWT fuel temperature, and maintaining an appropriate minimum fuel quantity in the CWT. (A-96-175)

Require that the 747 Flight Handbooks of TWA and other operators of 747s and other aircraft in which fuel tank temperature cannot be determined by flight crews be immediately revised to reflect the increases in center wing fuel tank (CWT) fuel temperatures found by flight tests, including operational procedures to reduce the potential for exceeding CWT temperature limits. (A-96-176)

Require modification of the center wing fuel tank of 747 airplanes and the fuel tanks of other airplanes that are located near heat sources to incorporate temperature probes and cockpit fuel tank temperature displays to permit determination of fuel tank temperatures. (A-96-177)

As a result this accident investigation, the Safety Board also issued the following recommendation to the FAA on February 18, 1997:

Develop and implement procedures, including a checklist of safety-related items, for the handling and placement of explosive training aids by K-9 explosives detection teams to prevent contamination of aircraft and airport facilities and to ensure an effective K-9 explosives detection program. (A-97-11)

As a result of this accident investigation, the Safety Board also issued the following recommendations to the FAA on April 7, 1998:

Issue, as soon as possible, an airworthiness directive to require a detailed inspection of fuel quantity indication system wiring in Boeing 747-100, -200, and -300 series airplane fuel tanks for damage, and the replacement or the repair of any wires found to be damaged. Wires on Honeywell Series 1-3 probes and compensators should be removed for examination. (A-98-34)

Issue an airworthiness directive to require the earliest possible replacement of the Honeywell Corporation Series 1-3 terminal blocks used on Boeing 747 fuel probes with terminal blocks that do not have knurled surfaces or sharp edges that may damage fuel quantity indication system wiring. (A-98-35)

Conduct a survey of fuel quantity indication systems probes and wires in Boeing 747s equipped with systems other than Honeywell Series 1-3 probes and compensators and in other model airplanes that are used in Title 14 *Code of Federal Regulations* Part 121 service to determine whether potential fuel tank ignition sources exist that are similar to those found in the 747. The survey should include removing wires from fuel probes and examining the wires for damage. Repair or replacement procedures for any damaged wires that are found should be developed. (A-98-36)

Require research into copper-sulfide deposits on fuel quantity indication system parts in fuel tanks to determine the levels of deposits that may be hazardous, how to inspect and clean the deposits, and when to replace the components. (A-98-37)

Require in Boeing 747 airplanes, and in other airplanes with fuel quantity indication system (FQIS) wire installations that are corouted with wires that may be powered, the physical separation and electrical shielding of FQIS wires to the maximum extent possible. (A-98-38)

Require, in all applicable transport airplane fuel tanks, surge protection systems to prevent electrical power surges from entering fuel tanks through fuel quantity indication system wires. (A-98-39)

For additional information about these recommendations, see section 1.18.3 of this report.

### 4.3 Previously Issued Recommendations Classified in This Report

The following previously issued recommendations are classified in this report:<sup>661</sup>

- Safety Recommendation A-96-174 (previously classified “Open—Unacceptable Response”) is classified “Open—Acceptable Response” in section 2.4.2 of this report.
- Safety Recommendation A-96-175 (previously classified “Open—Unacceptable Response”) is classified “Open—Acceptable Response” in section 2.4.2 of this report.
- Safety Recommendation A-98-37 (previously classified “Open—Acceptable Response”) is classified “Closed—Acceptable Action—Superseded” in section 2.3.2.2.3.1 of this report.
- Safety Recommendation A-98-38 (previously classified “Open—Acceptable Response”) is again classified “Open—Acceptable Response” in section 2.3.2.1.2.2.3 of this report.
- Safety Recommendation A-98-39 (previously classified “Open—Unacceptable Response”) is classified “Open—Acceptable Response” in section 2.3.2.1.2.2.4 of this report.

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<sup>661</sup> For the text of these recommendations, see section 4.2.